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Fefferman

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(54) **ON-SCREEN CODE STABILIZATION**

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G06Q 20/32	(2012.01)
G06K 19/06	(2006.01)
G06T 3/20	(2006.01)
G06T 3/60	(2006.01)
G06T 3/00	(2006.01)
G06T 3/40	(2006.01)
G06Q 20/20	(2012.01)

(52) **U.S. Cl.**

CPC ***G06Q 20/3274*** (2013.01); ***G06K 19/06112*** (2013.01); ***G06Q 20/208*** (2013.01); ***G06Q 20/32*** (2013.01); ***G06Q 20/3276*** (2013.01); ***G06T 3/0006*** (2013.01); ***G06T 3/20*** (2013.01); ***G06T 3/40*** (2013.01); ***G06T 3/60*** (2013.01)

(58) **Field of Classification Search**

USPC 235/435, 439, 454, 462

See application file for complete search history.

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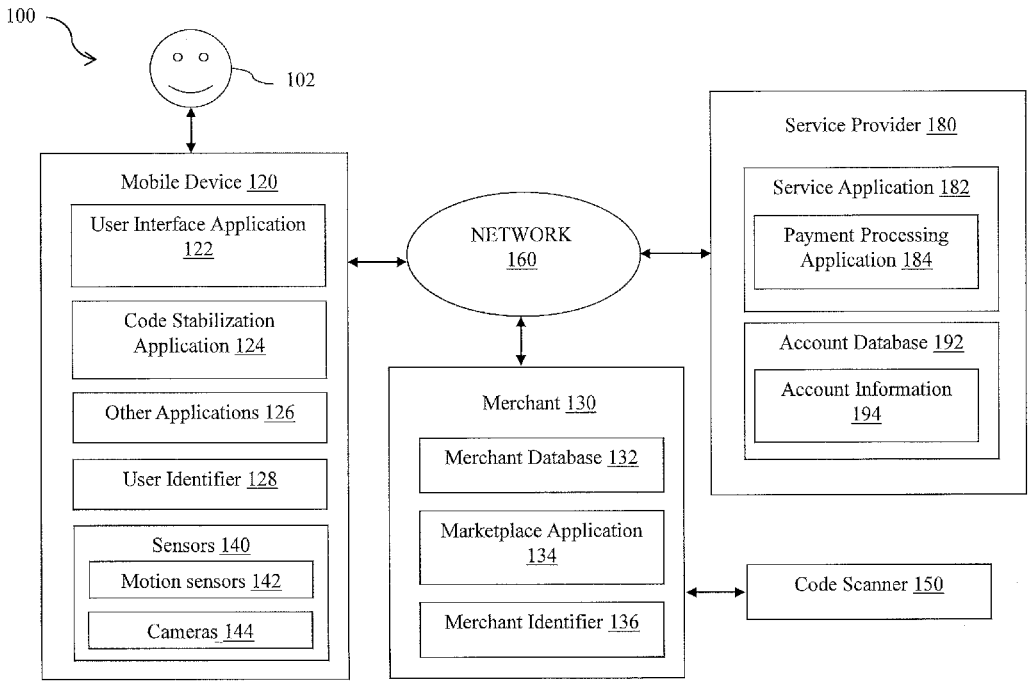
(57) **ABSTRACT**

Methods and systems for stabilizing an on-screen code on a display of a mobile device are described. A code is displayed on a mobile device as an on-screen code. The user holds the mobile device in front of a code scanner so that the on-screen code can be scanned. A code stabilization application on the mobile device assists in stabilizing and/or centering the on-screen code through changing its position, shape, and/or size based on data and/or measurements from sensors. The code stabilization application stabilizes the on-screen code for easy scan-ability to speed up the scanning process.

20 Claims, 7 Drawing Sheets



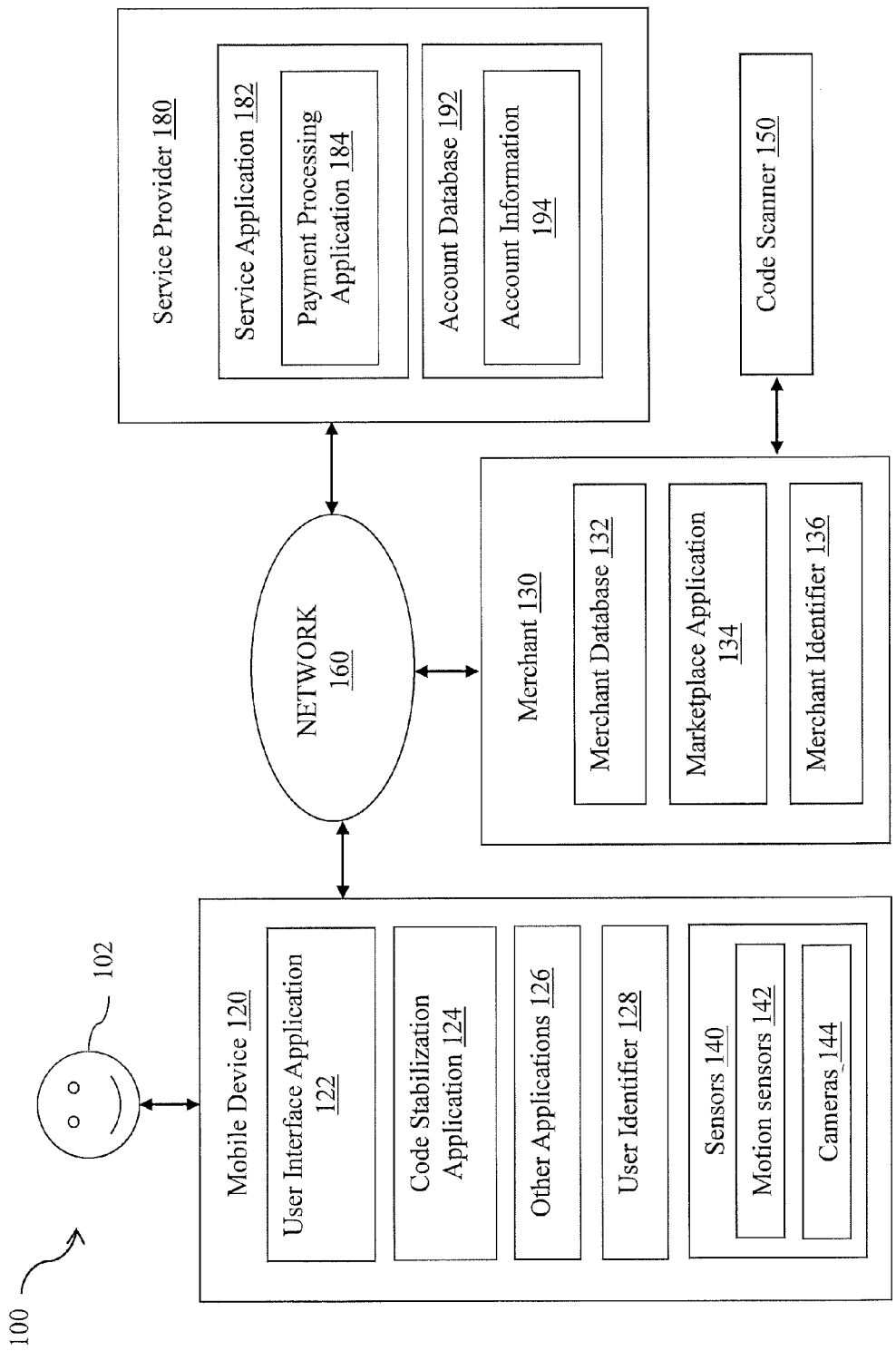

100
102
Mobile Device 120
User Interface Application 122
Code Stabilization Application 124
Other Applications 126
User Identifier 128
Sensors 140
Motion sensors 142
Cameras 144
NETWORK 160
Merchant 130
Merchant Database 132
Marketplace Application 134
Merchant Identifier 136
Service Provider 180
Service Application 182
Payment Processing Application 184
Account Database 192
Account Information 194
Code Scanner 150

FIG. 1

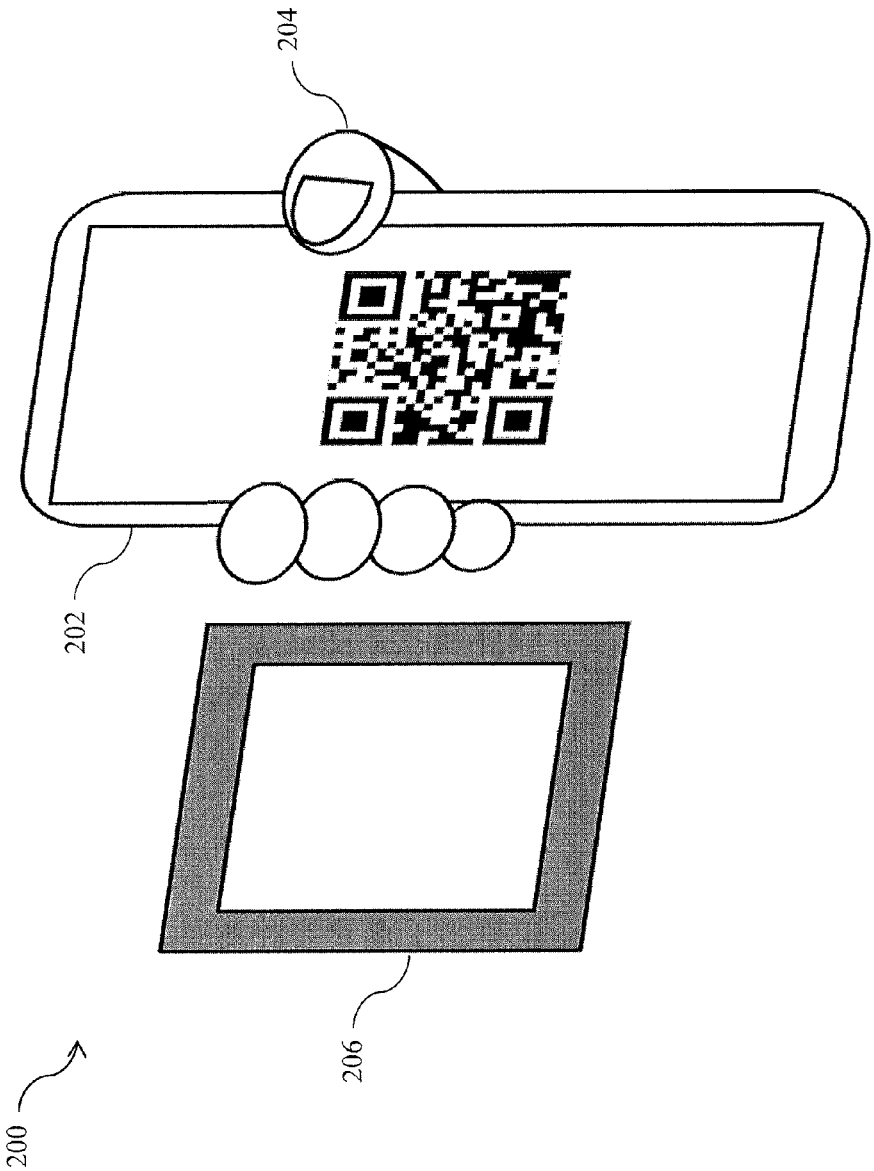


FIG. 2

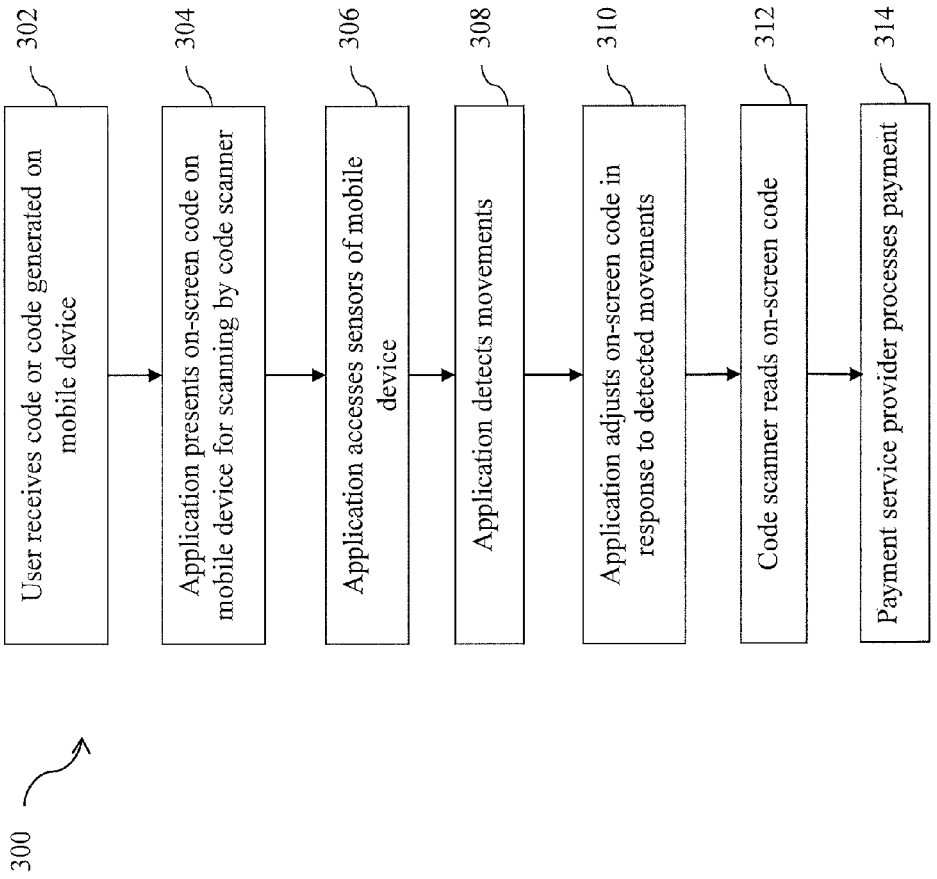

300
302
User receives code or code generated on mobile device
304
Application presents on-screen code on mobile device for scanning by code scanner
306
Application accesses sensors of mobile device
308
Application detects movements
310
Application adjusts on-screen code in response to detected movements
312
Code scanner reads on-screen code
314
Payment service provider processes payment

FIG. 3

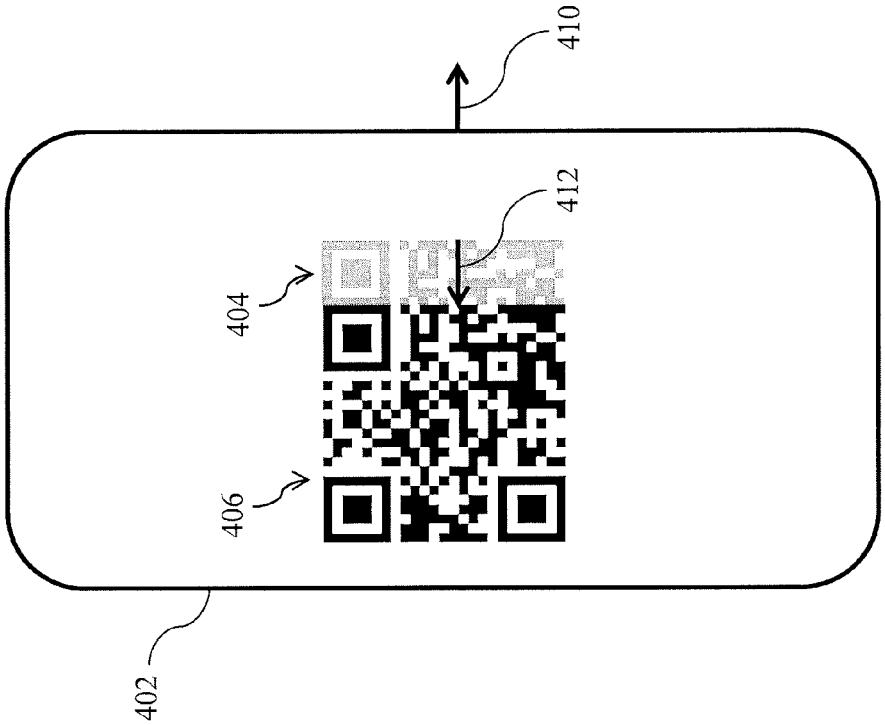


FIG. 4A

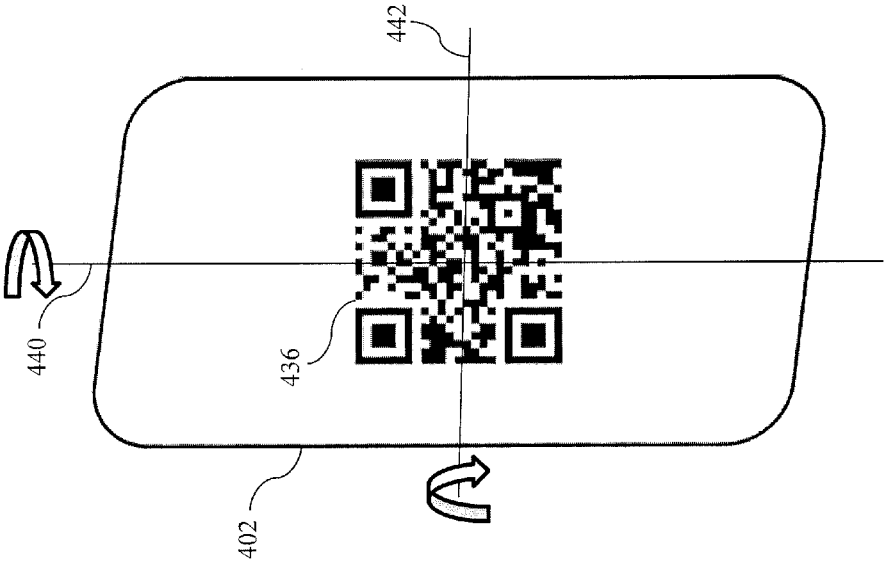


FIG. 4C

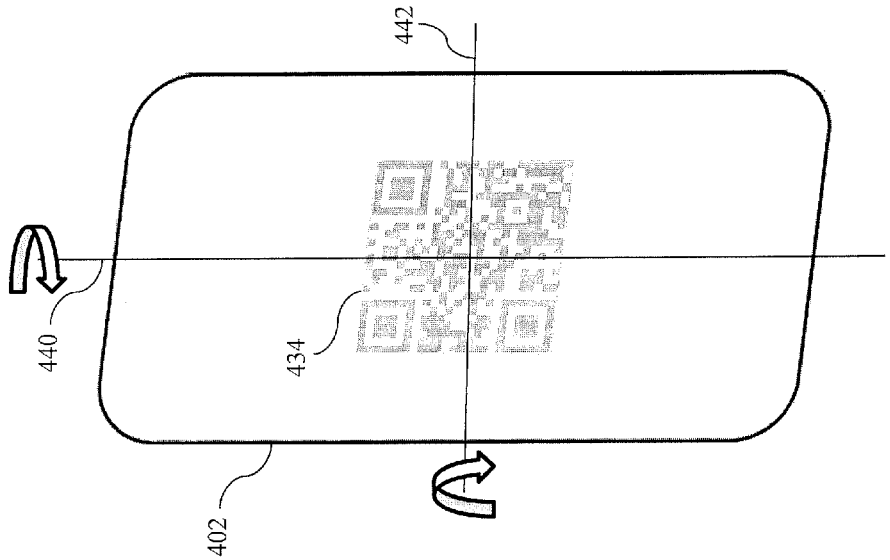


FIG. 4B

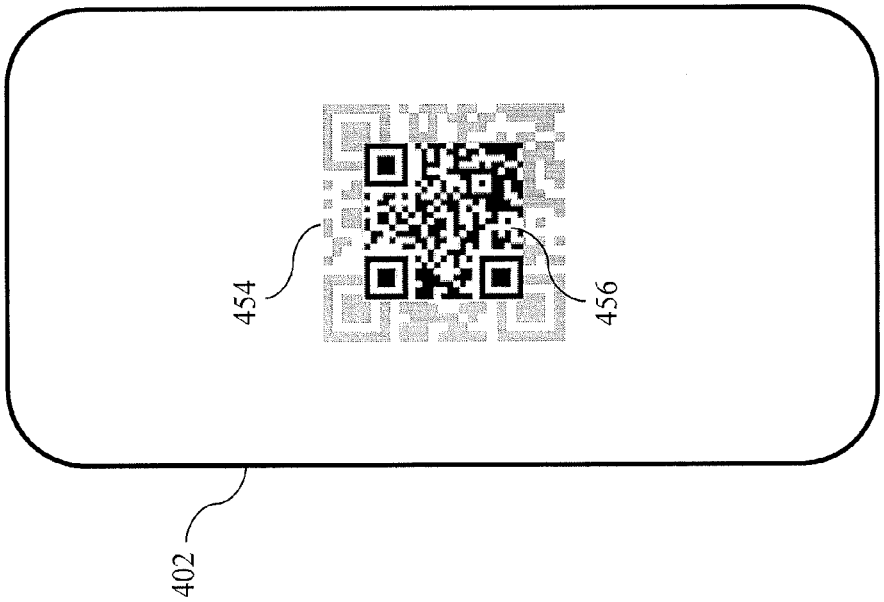


FIG. 4D

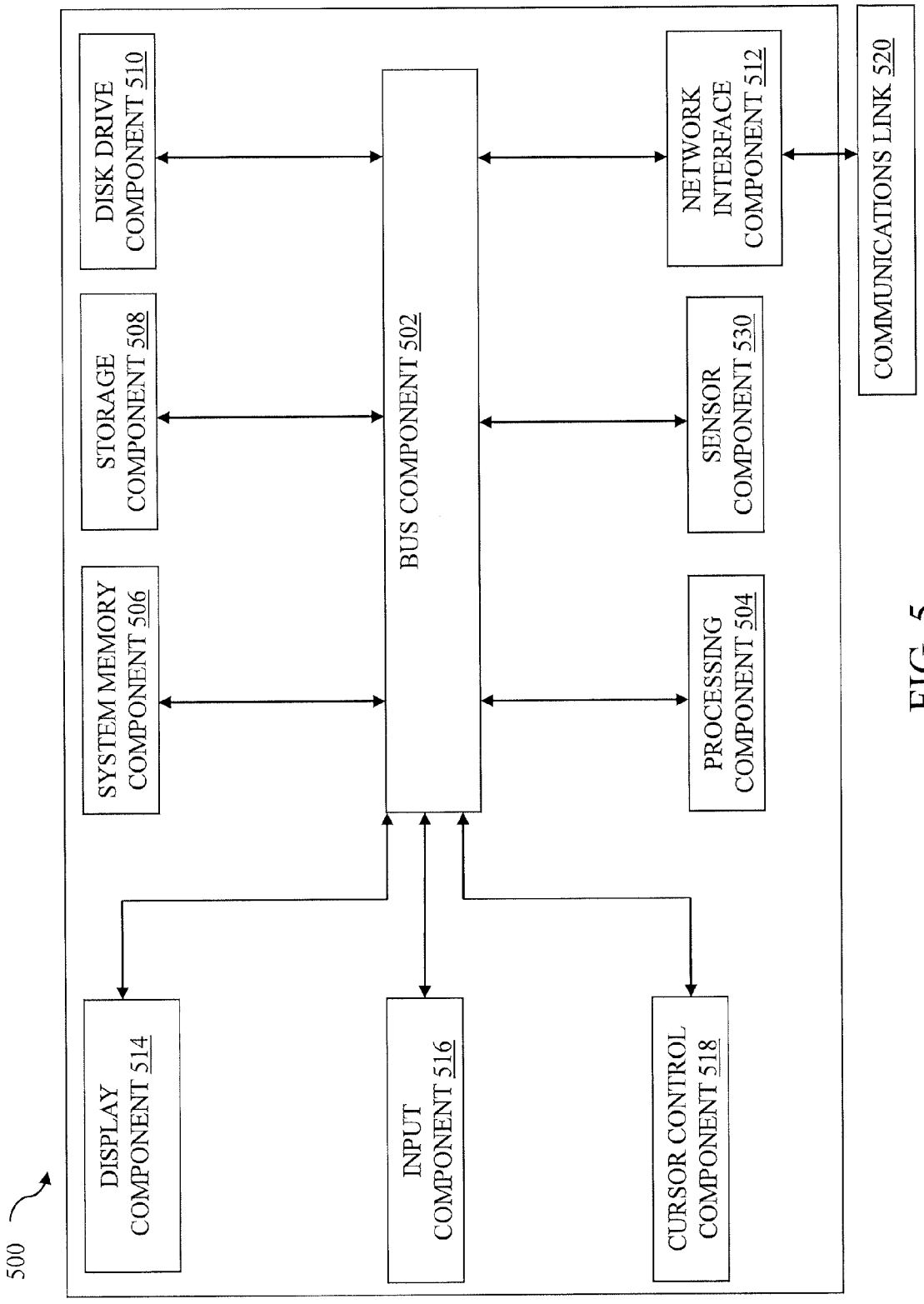

500
DISPLAY COMPONENT 514
INPUT COMPONENT 516
CURSOR CONTROL COMPONENT 518
SYSTEM MEMORY COMPONENT 506
STORAGE COMPONENT 508
DISK DRIVE COMPONENT 510
BUS COMPONENT 502
PROCESSING COMPONENT 504
SENSOR COMPONENT 530
NETWORK INTERFACE COMPONENT 512
COMMUNICATIONS LINK 520

FIG. 5

ON-SCREEN CODE STABILIZATION

BACKGROUND

1. Field of the Invention

The present invention generally relates to stabilizing an on-screen code on a mobile device for scanning by a code scanner.

2. Related Art

A user may present a code displayed on a mobile device, such as a barcode or a Quick Response (QR) code, to make a purchase from a merchant or to present an e-ticket at an airport or an event. The code is scanned by a code scanner. When the scanning process takes a few moments, the user may believe that it is user error in the placement of the code relative to the code scanner. The user may shift the mobile device around to adjust the code in an attempt to get the code scanned. However, the code scanner can detect the code in most positions as long as it is stable. Whether the user moves the code intentionally to have it read or unintentionally due to unsteady hands, movement of the code disrupts the scanning process and adds to the time it takes to complete the scan.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a block diagram illustrating a system for stabilizing an on-screen code according to an embodiment of the present disclosure;

FIG. **2** is a flowchart showing a method for stabilizing an on-screen code according to an embodiment of the present disclosure;

FIG. **3** is an illustration of a mobile device displaying a code held in front of a code scanner by a user according to an embodiment of the present disclosure;

FIGS. **4**A-D are illustrations of an on-screen code that is adjusted in response to movement of a mobile device according to an embodiment of the present disclosure; and

FIG. **5** is a block diagram of a system for implementing one or more components in FIG. **1** according to an embodiment of the present disclosure.

Embodiments of the present disclosure and their advantages are best understood by referring to the detailed description that follows. It should be appreciated that like reference numerals are used to identify like elements illustrated in one or more of the figures, wherein showings therein are for purposes of illustrating embodiments of the present disclosure and not for purposes of limiting the same.

DETAILED DESCRIPTION

The present disclosure describes stabilizing and/or centering a code that is displayed on a user device to facilitate scanning by a code scanner. The user device may be a mobile device, such as a mobile phone, smart watch, or a tablet. The code displayed on the user device, i.e., the on-screen code, is adjusted in response to motion detected by sensors in the user device. The on-screen code may be a barcode, such as a QR code. The on-screen code can be used, for example, to make a payment, identify a user, enable a digital wallet experience at the time of payment, improve payment security, gain entry at an event, or check-in at an airport. The on-screen code is placed in front of a code scanner that scans the on-screen code.

The barcode is a coded pattern of graphical indicia that includes of a series of stripes and spaces of varying widths, the stripes and spaces having differing light reflecting characteristics. Some of the more popular barcode symbologies include: Uniform Product Code (UPC), typically used in retail stores sales; Data Matrix, typically used for labeling small electronic products; Code 39, primarily used in inventory tracking; and Postnet, which is used for encoding zip codes for U.S. mail. Barcodes may be one dimensional (1D), i.e., a single row of graphical indicia that carry information in one direction, such as a UPC barcode, or two dimensional (2D), i.e., multiple rows of graphical indicia that carry information in two directions, such as Data Matrix which includes multiple rows and columns of black and white square modules arranged in a square or rectangular pattern. Other examples of 2D barcodes include PDF417, Maxi-Code, Aztec™ barcode, and the QR Code. A QR code is a matrix barcode, readable by QR scanners, mobile phones with a camera, and smartphones. The QR code consists of modules arranged in a square pattern on a white background. The information encoded can be text, a uniform resource locator (URL) or other data.

The systems and methods described herein stabilize an on-screen code to facilitate scanning by a code scanner. An application displays a code on a mobile device as an on-screen code. The user holds the display of the mobile device in front of a code scanner so that the display is facing the code scanner for scanning of the on-screen code. A code stabilization application or module assists in stabilizing the on-screen code through changing the position, shape (e.g., to a trapezoid shape), and/or size of the on-screen code based on data and/or measurements from sensors. The sensors may comprise gyroscopes, accelerometers, and/or cameras. The code stabilization application stabilizes the on-screen code for easy scan-ability to speed up the scanning process.

For example, when the user moves the mobile device to the right relative to the code scanner, the application detects the movement and adjusts the on-screen code to the left. If the user moves the mobile device towards or away from the code scanner, the application adjusts the size of the on-screen code. Similarly, if the user tilts the mobile device relative to the code scanner, the application adjusts the size and/or shape of the on-screen code to counter this movement.

In an embodiment, the code is a payment code that is generated by a payment service provider, such as PayPal®, Inc. of San Jose, Calif. The payment code is associated with a user account, and can be used at a retail location during checkout. The payment code can be used by the user to make a payment anywhere, such as a particular retail location, and to make a payment even without Internet access. In some embodiments, the payment code is associated with at least one merchant.

In various embodiments, a payment service provider receives identifying information from a user, such as login information (e.g., user name, password, etc.). The payment service provider then generates a payment code and transmits the payment code to the user. The user receives the payment code and the payment code is displayed on a mobile device. When the user is checking out at a merchant, the payment code displayed on a mobile device is scanned by a code scanner at a point of sale (POS) of the merchant. The merchant transmits the payment code back to the payment service provider. The payment service provider receives the payment code, along with a request for a payment from the merchant, and processes the payment.

In an embodiment, the payment code is a barcode, such as a QR code, that may be scanned at a POS of a merchant. Other machine readable codes may also be suitable. In

certain embodiments, the payment code can be converted into a virtual card number at the POS to pay for a purchase.

In some embodiments, the user can control and set various limits on use of the payment code. For example, the user can limit the price of items to be purchased using the payment code, the places that the payment code can be used, the times of day the payment code can be used, the types of items to be purchased with the payment code, etc.

In further embodiments, use of the payment code facilitates identification of the user, the user's order, or the user's transaction at the POS. The use of the mobile application provides access to the user's location, his or her device information, and user credentials. Having one or more of these pieces of information can build stronger identity authentication.

For example, the payment code may advantageously act as the user's identification so a user need not provide the typical forms of identification (e.g., driver's license, credit card, etc.) to prove identity when picking up an item that was previously ordered. Instead, the user's mobile device is used to facilitate stronger identity authentication and improve payment security to improve the user experience.

In one embodiment, a user authenticates his identity to a mobile application run by a payment service provider such as PayPal®, Inc. of San Jose, Calif., on a mobile device. The payment service provider identifies the user, generates the payment code, and transmits the payment code to the user's mobile device. An application on the mobile device then displays the payment code on the mobile device as an on-screen code, which is scanned by a code scanner at the POS of the merchant. The payment code acts as the user's identification, as the payment code is generated with a valid login session or authorization.

In various embodiments, an electronic ticket for an event or transportation includes a code. For example, the user may provide the code to a code scanner to gain entry at an event. In another example, the user may scan the code at the airport to check-in for a flight.

By having the ability to stabilize the code if needed during scanning, various advantages are achieved. For example, both the user and the merchant are able to more quickly finish a transaction based on the code being scanned, without the scanner having to rescan the code if the device is moved. The user is spared the frustration of moving or repositioning the mobile device one or more times during the transaction. Wait times for other users may be reduced, thereby providing a better experience for consumers.

FIG. **1** shows one embodiment of a block diagram of a network-based system **100** that includes a mobile device **120** configured to stabilize an on-screen code on the mobile device according to an embodiment of the present disclosure. As shown, system **100** may comprise or implement a plurality of servers and/or software components that operate to perform various methodologies in accordance with the described embodiments. Exemplary servers may include, for example, stand-alone and enterprise-class servers operating a server OS such as a MICROSOFT® OS, a UNIX® OS, a LINUX® OS, or other suitable server-based OS. It can be appreciated that the servers illustrated in FIG. **1** may be deployed in other ways and that the operations performed and/or the services provided by such servers may be combined or separated for a given implementation and may be performed by a greater number or fewer number of servers. One or more servers may be operated and/or maintained by the same or different entities.

As shown in FIG. **1**, system **100** includes mobile device **120** (e.g., a smartphone), one or more merchant servers or devices **130** (e.g., network server devices), one or more code scanners or readers **150**, and at least one payment service provider server or device **180** (e.g., network server device) in communication over a network **160**. Network **160**, in one embodiment, may be implemented as a single network or a combination of multiple networks. For example, in various embodiments, network **160** may include the Internet and/or one or more intranets, landline networks, wireless networks, and/or other appropriate types of communication networks. In another example, network **160** may comprise a wireless telecommunications network (e.g., cellular phone network) adapted to communicate with other communication networks, such as the Internet. As such, in various embodiments, mobile device **120**, merchant servers or devices **130**, and payment service provider server or device **180** may be associated with a particular link (e.g., a link, such as a URL (Uniform Resource Locator) to an IP (Internet Protocol) address).

Mobile device **120**, in one embodiment, may be utilized by a user **102** to interact with payment service provider server **180** over network **160**. For example, user **102** may conduct financial transactions (e.g., account transfers) with payment service provider server **180** via mobile device **120**. Mobile device **120**, in various embodiments, may be implemented using any appropriate combination of hardware and/or software configured for wired and/or wireless communication over network **160**. In various implementations, mobile device **120** may include at least one of a wireless cellular phone, wearable computing device, satellite phone, computing tablet, etc.

Mobile device **120**, in one embodiment, includes a user interface application **122**, which may be utilized by user **102** to conduct transactions (e.g., shopping, purchasing, bidding, etc.) with merchant server or device **130** or with payment service provider server **180** over network **160**. In one aspect, purchase expenses may be directly and/or automatically debited from an account related to user **102** via user interface application **122**.

In one implementation, user interface application **122** comprises a software program, such as a graphical user interface (GUI), executable by a processor that is configured to interface and communicate with payment service provider server **180** via network **160**. In another implementation, user interface application **122** comprises a browser module that provides a network interface to browse information available over network **160**. For example, user interface application **122** may be implemented, in part, as a web browser to view information available over network **160**.

In an example, user **102** is able to access merchant websites or apps via one or more merchant servers **130** to view and select items for purchase, and user **102** is able to purchase items from one or more merchant servers **130** via service provider server **180**. Accordingly, in one or more embodiments, user **102**, in person or remotely, may conduct transactions (e.g., purchase and provide payment for one or more items) from one or more merchant servers **130** via service provider server **180**.

Mobile device **120**, in various embodiments, includes a code stabilization application **124**. Code stabilization application **124** may be a module in another application or a separate application. Code stabilization application **124** stabilizes an on-screen code by redisplaying the code on the display of mobile device **120** by adjusting the position, shape, size, or a combination thereof, of the on-screen code. Code stabilization application **124** may receive data and/or measurements from sensors **140** of mobile device **120**. Code stabilization application **124**, in several embodiments, is

developed by a payment service provider and is downloaded to mobile device **120** from the payment service provider website. Code stabilization application **124**, in certain embodiments, generates codes on mobile device **120**, accesses data from sensors **140**, detects movement, and adjusts the on-screen code in response to the detected movements.

In various embodiments, mobile device **120** includes one or more sensors **140**, such as motion sensors **142** and/or cameras **144**. Motion sensors **142** can monitor, detect, and/or measure movement, velocity, acceleration of mobile device **120**, such as translational motion, translational velocity, translational acceleration, rotation, angular velocity, and angular acceleration. Motion sensors **142** may comprise one or more gyroscopes and/or one or more accelerometers. Thus, motion sensors **142** are configured to detect when mobile device **120** has been tilted on any axis, moved left or right, forward or backwards, and up or down by user **102**. Motion sensors **142** may be accessed by code stabilization application **124**.

Cameras **144** may be configured to capture images, monitor and detect movement of objects, and sense depth. A front-facing camera may detect code scanner **150**, or a part of code scanner **150**, and determine the center of code scanner **150**. The front-facing camera may also detect whether mobile device **120** is facing, or turned away from, the face of user **102**. In an embodiment, mobile device **120** includes at least two front-facing cameras configured to determine distance to objects. For example, mobile device **120** may include a main front-facing camera and two or more depth-sensing cameras to sense distance to objects.

Mobile device **120**, in various embodiments, may include other applications **126** as may be desired in one or more embodiments of the present disclosure to provide additional features available to user **102**. In one example, such other applications **126** may include security applications for implementing client-side security features, programmatic client applications for interfacing with appropriate application programming interfaces (APIs) over network **160**, and/or various other types of generally known programs and/or software applications. In still other examples, other applications **126** may interface with user interface application **122** for improved efficiency and convenience.

In various implementations, a user profile may be created using data and information obtained from cell phone activity over network **160**. Cell phone activity transactions may be used by payment service provider server **180** to create at least one user profile for user **102** based on activity from mobile device **120** (e.g., cell phone). The user profile may be updated with each financial and/or information transaction (e.g., payment transaction, purchase transaction, etc.) achieved through use of mobile device **120**. In various aspects, this may include the type of transaction and/or the location information from mobile device **120**. As such, the profile may be used for recognizing patterns of potential fraud, setting transaction limits on the user, etc.

Mobile device **120**, in one embodiment, may include at least one user identifier. **128**, which may be implemented, for example, as operating system registry entries, cookies associated with user interface application **122**, identifiers associated with hardware of mobile device **120**, or various other appropriate identifiers. User identifier **128** may include one or more attributes related to user **102**, such as personal information related to user **102** (e.g., one or more user names, passwords, photograph images, biometric IDs, addresses, phone numbers, social security number, etc.) and banking information and/or funding sources (e.g., one or more banking institutions, credit card issuers, user account numbers, security data and information, etc.). In various implementations, user identifier **128** may be passed with a user login request to payment service provider server **180** via network **160**, and user identifier **128** may be used by payment service provider server **180** to associate user **102** with a particular user account maintained by payment service provider server **180**.

In various implementations, user **102** is able to input data and information into an input component (e.g., a touch-screen, a keyboard, etc.) of mobile device **120** to provide user information with a transaction request, such as a fund transfer request. The user information may include user identification information.

One or more merchant servers **130**, in various embodiments, may be maintained by one or more business entities (or in some cases, by a partner of a business entity that processes transactions on behalf of business entities). Examples of businesses entities include merchant sites, resource information sites, utility sites, real estate management sites, social networking sites, etc., which offer various items for purchase and payment. In some embodiments, business entities may need registration of the user identity information as part of offering the items to user **102** over network **160**. As such, each of one or more merchant servers **130** may include a merchant database **132** for identifying available items, which may be made available to mobile device **120** for viewing and purchase by user **102**. In one or more embodiments, user **102** may complete a transaction such as purchasing the items via payment service provider server **180**.

Each of the merchant servers **130**, in one embodiment, may include a marketplace application **134**, which may be configured to provide information over network **160** to user interface application **122** of mobile device **120**. For example, user **102** may interact with marketplace application **134** through user interface application **122** over network **160** to search and view various items available for purchase in merchant database **132**.

Each of the merchant servers **130**, in one embodiment, may include at least one merchant identifier **136**, which may be included as part of the one or more items made available for purchase so that, for example, particular items are associated with particular merchants. In one implementation, merchant identifier **136** may include one or more attributes and/or parameters related to the merchant, such as business and banking information. In various embodiments, user **102** may conduct transactions (e.g., searching, selection, monitoring, purchasing, and/or providing payment for items) with each merchant server **130** via payment service provider server **180** over network **160**.

A merchant website may also communicate (e.g., using merchant server **130**) with the service provider through payment service provider server **180** over network **160**. For example, the merchant website may communicate with the payment service provider in the course of various services offered by the payment service provider to merchant website, such as payment intermediary between customers of the merchant website and the merchant website itself. For example, the merchant website may use an application programming interface (API) that allows it to offer sale of goods in which customers are allowed to make payment through the payment service provider, while user **102** may have an account with the payment service provider that allows user **102** to use the payment service provider for making payments to merchants that allow use of authentication, authorization, and payment services of payment

service provider as a payment intermediary. The merchant website may also have an account with the payment service provider.

Code scanner or reader **150** may include one or more devices or systems used to read codes on mobile devices **120**. For example, code scanner **150** may include a barcode scanner/reader or a QR code scanner/reader. Code scanner **150** is typically positioned at a PUS of a merchant. Examples of suitable locations for the PUS include, but are not limited to, an entrance to or within an event, such as a concert, sporting event, convention, trade show, movie theater, theater, fair, etc., airline security checkpoints and boarding gates, unmanned kiosks and vending machines, transportation (e.g., train, subway, bus) entrances and exits, etc.

Payment service provider server **180**, in one embodiment, may be maintained by a transaction processing entity or an online service provider, which may provide processing for financial transactions and/or information transactions between user **102** and one or more of the merchant servers **130**. As such, payment service provider server **180** includes a service application **182**, which may be adapted to interact with mobile device **120** and/or each merchant server **130** over network **160** to facilitate the searching, selection, purchase, and/or payment of items by user **102** from one or more of the merchant servers **130**. In one example, payment service provider server **180** may be provided by PayPal®, Inc., eBay® of San Jose, Calif., USA, and/or one or more financial institutions or a respective intermediary that may provide multiple point of sale devices at various locations to facilitate transaction routings between merchants and, for example, financial institutions.

Service application **182**, in one embodiment, utilizes a payment processing application **184** to process purchases and/or payments for financial transactions between user **102** and each merchant server **130**. In one implementation, the payment processing application **184** assists with resolving financial transactions through validation, delivery, and settlement. As such, service application **182** in conjunction with payment processing application **184** settles financial transactions between user **102** and each merchant **130**, wherein accounts may be directly and/or automatically debited and/or credited of monetary funds in a manner as accepted by the banking industry.

Payment service provider server **180**, in one embodiment, may be configured to maintain one or more user accounts and merchant accounts in an account database **192**, each of which may include account information **194** associated with one or more individual users (e.g., user **102**) and merchants (e.g., one or more merchants associated with merchant servers **130**). For example, account information **194** may include private financial information of user **102** and each merchant associated with one or more merchant servers **130**, such as one or more account numbers, passwords, credit card information, banking information, or other types of financial information, which may be used to facilitate financial transactions between user **102**, and one or more merchants associated with the merchant servers **130**. In various aspects, the methods and systems described herein may be modified to accommodate users and/or merchants that may or may not be associated with at least one existing user account and/or merchant account, respectively.

In one implementation, user **102** may have identity attributes stored with payment service provider server **180**, and user **102** may have credentials to authenticate or verify identity with payment service provider server **180**. User attributes may include personal information, banking information and/or funding sources. In various aspects, the user attributes may be passed to payment service provider server **180** as part of a login, search, selection, purchase, and/or payment request, and the user attributes may be utilized by payment service provider server **180** to associate user **102** with one or more particular user accounts maintained by payment service provider server **180**.

Referring now to FIG. **2**, illustrated is a scene **200** of mobile device **202** displaying a code held in front of code scanner **150** by user **102** according to an embodiment of the present disclosure. Mobile device **202** displaying a code held by a hand **204** of user **102** is placed in front of a code scanning component **206** of code scanner **150**. Code scanning component **206** scans the on-screen code. Mobile device **202** is implemented in a similar manner as mobile device **120** described above.

Referring now to FIG. **3**, a flowchart of a method **300** for stabilizing an on-screen code on mobile device **120** is illustrated according to an embodiment of the present disclosure. Code generation may be triggered by the manually by the user or automatically by the system. For example, the user may send a request through mobile device **120**, such as by selecting a "Request Code" button from a service provider app. In another example, mobile device **120** may be detected as being in a payment situation, such as entering a merchant store, entering a checkout line, or receiving a payment request from the merchant. Codes may also accessible through mobile device **120**, such that the user can retrieve a code to be displayed.

At step **302**, user **102** receives a code from a payment service provider, or a code-generating application on mobile device **120** generates a code. In an embodiment, payment service provider server **180** generates and sends a code to mobile device **120**. The code may be a payment code associated with a user account maintained by the payment service provider. Further, the payment service provider may store user account information **194** in account database **192** that includes one or more accounts of user **102**. The payment code may be linked to the account such that when the payment code is presented to a merchant, the account to be used for the transaction is designated. In another embodiment, a user **102** receives an e-ticket that includes the code. For example, user **102** may receive an e-ticket from an airline for a flight that includes a barcode that can be scanned during check-in and/or boarding process.

In a further embodiment, user **102** uses a code-generating application on the mobile device **120** to generate a code. The code-generating application may be an application provided by a payment service provider, or by a third-party service provider. When the code is generated by an application of the payment service provider and the code is transmitted to payment service provider server **180**, payment service provider server **180** is able to identify a user account associated with the code and/or authenticate the code, for example, based on an algorithm used for generating the code implemented by the payment service provider.

In an embodiment, user **102** registers with a payment service provider. Registration may include signing up for the service and agreeing to any terms required by the payment service provider, such as through a user device. The user device may be a mobile computing device, such as a smart phone, a PC, or a computing tablet. Registration may be done completely through the user device, partially through the user device, or without using the user device, such as through a phone call or in-person visit to a representative of the payment service provider.

User **102** may be requested to provide specific information for registration, such as, but not limited to, a name, address, phone number, email address, picture, a user name for the account, and a password or PIN for the account. The type of information may depend on whether the user already has an account with the payment service provider. Requested information may be entered through the user device or other means, including voice or manual key entry. Once all the requested information is received and confirmed, the payment service provider may create an account for user **102**.

In some embodiments, user **102** provides identifying data, e.g., user name, password, etc., before user **102** can use the code. For example, user **102** may be required to provide identifying data before receiving the code or generating the code on mobile device **120**. In another example, user **102** may be required to provide identifying data when the code is to be presented on the display of mobile device **120** for use.

The code, in one embodiment, is randomly generated, such as a random barcode. In some exemplary embodiments, the payment code may be a random one-time use code that is generated by the payment service provider executing a random character generation program. The payment code may be sent to mobile device **120** of user **102** in any suitable way, including by email, text, push notification, or by download from payment service provider server **180** through an application or a web browser. In certain embodiments, limitations or restrictions may be associated with the code, such as amount, time of use, type of purchase, etc.

At step **304**, an application on the mobile device (e.g., code-generating application or code stabilization application **124**) presents the code on a display of mobile device **120** as an on-screen code. In an embodiment, before or after the code is generated, user **102** may browse and select items that he or she wishes to purchase at a merchant. When user **102** is ready to pay for the purchase, user **102** uses the application to display the on-screen code on mobile device **120** and places the on-screen code in front of code scanner/reader **150** at the POS of the merchant.

At step **306**, code stabilization application **124**, which may be a part of the application used to display the on-screen code or a separate application, accesses sensors **140** of mobile device **120**. In an embodiment, code stabilization application **124** accesses motion sensors **142** comprising a gyroscope and/or an accelerometer. In some embodiments, code stabilization application **124** accesses one or more cameras **144** of mobile device **120**. In other embodiments, code stabilization application **124** accesses both motion sensors **142** and cameras **144**. Code stabilization application **124** receives data and/or measurements from sensors **140**. To conserve power, sensors **140** may only be activated when a possible code scan is determined, such as the code being displayed on mobile device **120** and/or cameras **144** on mobile device **120** detecting code scanner/reader **150** facing the display of mobile device **120**.

At step **308**, code stabilization application **124** detects movements using sensors **140**. In certain embodiments, code stabilization application **124** detects movements by accessing motion sensors **142**. The code stabilization application **124** can then compute movements of mobile device **120** based on data and/or measurements received from motion sensors **142**.

In other embodiments, code stabilization application **124** receives data from a front-facing camera of the mobile device. The front-facing camera detects code scanner/reader **150**, or one or more parts of code scanner/reader **150**, and determines movement relative to code scanner/reader **150**.

At step **310**, code stabilization application **124**, which can use various known image stabilization methods, adjusts the on-screen code in response to the movements that are detected by sensors **140**. In an embodiment, the on-screen code is adjusted by redisplaying the on-screen code on the display at an adjusted position, adjusted shape, and/or adjusted size such that the on-screen code is stable relative to code scanner/reader **150**. The on-screen code is adjusted such that the code remains the same from the perspective of code scanner/reader **150**.

In some embodiments, code stabilization application **124** uses data from the front-facing camera to adjust the on-screen code. The on-screen code is adjusted such that the center of the on-screen code is aligned with the center of code scanner/reader **150**.

In various embodiments, code stabilization application **124** starts adjusting the on-screen code when the display is facing code scanner **150**. Code stabilization application **124** determines or approximates when the on-screen code has been turned to face code scanner **150**. Code stabilization application **124** bases the timing of when to start adjusting on such determination or approximation. In one embodiment, code stabilization application **124** starts adjusting the on-screen code a specific length of time after the on-screen code is displayed on mobile device **120**. The on-screen code is displayed, then there is a delay for a predetermined time period (e.g., 2-3 seconds) to give user **102** time to turn mobile device **120** towards code scanner **150**, and then code stabilization application **142** starts to adjust the on-screen code.

In another embodiment, code stabilization application **124** starts adjusting the on-screen code when code stabilization application **124** determines through motion sensors **142** that user **102** has turned mobile device **120**. Code stabilization application **124** may be programmed to determine that when user **102** rotates mobile device **120** to one of several preset angles, the on-screen code has been turned to face code scanner **150**. The predetermined angles can include the various angles that correspond to a variety of ways that code scanner **150** may be set up. Code scanner **150** may be directly facing user **102** so that mobile device **120** has to be turned by about 180 degrees to face code scanner **150**. Code scanner **150** may be facing sideways such that mobile device **120** has to be turned by about 90 degrees. For example, when user **102** uses code stabilization application **124** to display the on-screen code and code stabilization application **124** detects a rotation of 90 degrees, code stabilization application **124** determines that the mobile device **120** has been turned to face code scanner **150** and accordingly starts to adjust the on-screen code.

In some embodiments, code stabilization application **124** starts adjusting the on-screen code based on camera **144** of mobile device **120**. For example, the front-facing camera may be configured to determine whether it is facing a face of user **102**. Code stabilization application **124** may access the front-facing camera and only start adjusting the on-screen code when the front-facing camera has been turned away from the face, i.e., the face is no longer detected by the front-facing camera. In another example, the front-facing camera may be configured to detect code scanner **150**, or one or more parts of code scanner **150**, such as code scanning component **306**. Code stabilization application **124** may access the front-facing camera and start adjusting the on-screen code when the front-facing camera detects code scanner **150** or the one or more parts of code scanner **150**,

so that code stabilization application **124** only adjusts the on-screen code while it is facing code scanner **150** to be scanned.

In an embodiment, code stabilization application **124** adjusts the on-screen code for a predetermined time period. For example, code stabilization application **124** may adjust the on-screen code for a time period that it usually takes for a scan to occur (e.g., 5-15 seconds), or a longer time period (e.g., 1-2 minutes).

In another embodiment, code stabilization application **124** adjusts the on-screen code for a predetermined time period, then resets, and again starts adjusting the on-screen code. When code scanner **150** is not able to scan the on-screen code at a first stabilized position, the on-screen code is stabilized at a second stabilized position after a predetermined time period. The predetermined time period may be the average time it takes for a scan to occur when the on-screen code is positioned in a correct orientation. For example, if code stabilization application **124** is stabilizing the on-screen code at a position that is out of scanning range, by providing a restart of the adjustment after a predetermined time period, the on-screen code can be re-centered on mobile device **120** and stabilized at a new position. Thus, code stabilization application **124** has a self-correcting mechanism.

At step **312**, code scanner **150** reads the on-screen code. For example, code scanner **150** reads the on-screen code by detecting light emitted by the display of mobile device **120**. In another example, code scanner **150** emits a source light, which bounces off the display of the mobile device **120**, and detects the light that is bounced back. In an embodiment, code scanner **150** is located at a POS of a merchant.

At step **314**, when the on-screen code is being used to make a purchase at a merchant, user **102** authorizes a payment from the user account to the merchant based on the scan of the on-screen code by code scanner **150** at the POS. In an embodiment, the code is transmitted from code scanner **150** to merchant server or device **130**. The payment service provider receives the code and a request for payment from merchant server or device **130**. Payment service provider server **180** verifies the code as the code associated with the user account, and may also verify any limitations or restrictions associated with the code. Payment service provider server **180** approves and processes the payment from the user account to the merchant. After processing, payment service provider server **180** may then transmit a notification to user **102** and/or merchant server or device **130**.

Now referring to FIGS. **4**A-D, on-screen codes that are adjusted in response to movement of a mobile device **402** are illustrated according to an embodiment of the present disclosure. FIG. **4**A illustrates adjusting of the code-image on mobile device **402** in response to translational motion, including horizontal and vertical movements. When mobile device **402** is moved in a direction **410**, the on-screen code that was displayed in a first location **404** is redisplayed at a second location **406** in response to the movement. Mobile device **402** displays the on-screen code at first location **404** before mobile device **402** is moved. Code stabilization application **124** uses sensors **140** comprising accelerometers to detect that mobile device **120** is being moved in direction **410**, and determines a magnitude of translational motion, direction of movement, velocity of movement, and acceleration of movement. In response to the movement, code stabilization application **124** dynamically redisplays the on-screen code in second position **406**. With respect to mobile device **402**, the position of the on-screen code has been adjusted in a direction **412** that is opposite the direction of movement of mobile device **402**. Code stabilization application **124** may calculate second position **406** based on the magnitude of translational motion, the direction **404** of movement, the velocity of movement, and/or the acceleration of movement.

FIGS. **4**B and **4**C illustrate adjusting the code-image on mobile device **402** in response to rotational movement. When mobile device **402** is rotated along one or more axes **440**, **442**, the on-screen code that was displayed with a first shape **434** is redisplayed with a second shape **436** in response to the rotation. Mobile device **402** displays the on-screen code with first shape **434** before mobile device **402** is rotated. Code stabilization application **124** uses sensors **140** comprising gyroscopes to detect that mobile device **402** is being rotated. Code stabilization application **124** determines magnitude of rotation, axis of rotation, direction of rotation, angular velocity, and/or angular acceleration. In response to the rotation, code stabilization application **124** dynamically redisplays the on-screen code with second shape **436**. Code stabilization application **124** may calculate second shape **436** based on the magnitude of rotation, the axis of rotation, the direction of rotation, the angular velocity, and/or the angular acceleration.

In certain embodiments, for further accuracy, code stabilization application **124** determines and/or measures a distance to code scanner **150** and calculates second shape **436** further based on the distance to code scanner **150**. In an embodiment, code stabilization application **124** accesses camera **144** comprising a front-facing camera to determine distance. For example, code stabilization application **124** may determine distance based on a standard size of code scanner **150** and/or code scanning component **206**. In another example, code stabilization application **124** may determine distance based on a reference marker on code scanner **150**. The reference marker may have a standard size such that it can be used for distance determinations. In another embodiment, code stabilization application **124** accesses cameras **144** comprising at least two front-facing cameras configured to sense depth to determine distance to code scanner **150**.

FIG. **4**D illustrates adjusting the code-image on mobile device **402** in response to movement towards or away from code scanner **150**. When mobile device **402** is moved forward, the on-screen code that was displayed in a first size **454** is redisplayed at a second size **456** in response to the movement. Mobile device **402** displays the on-screen code at first size **454** before mobile device **402** is moved. Code stabilization application **124** uses sensors **140** comprising accelerometers to detect that mobile device **402** is being moved forwards or backwards, and determines a magnitude of movement, direction of movement, velocity of movement, and/or acceleration of movement. In response to the movement, code stabilization application **124** dynamically redisplays the on-screen code in second size **456** such that the size remains the same from the point of view of the scanner. Code stabilization application **124** may calculate second size **456** based on the magnitude of movement, the direction of movement, the velocity of movement, the acceleration of movement, and/or the distance to code scanner **150**.

In certain embodiments, for further accuracy, code stabilization application **124** determines distance to code scanner **150** and calculates second size **456** further based on distance to code scanner **150**. In an embodiment, code stabilization application **124** uses camera **144** comprising a front-facing camera to determine distance based on a standard size of code scanner **150** and/or code scanning component, or based

on a reference marker on code scanner **150**. In another embodiment code stabilization application accesses cameras **144** comprising at least two front-facing cameras configured to sense depth to determine distance to code scanner **150**.

When the movement of mobile device **402** includes more than one of translational motion, rotation, and movement forwards or backwards, code stabilization application **124** performs adjustments comprising a combination of position adjustments, shape adjustments, and/or size adjustments, discussed above.

Referring now to FIG. **5**, a block diagram of a system **500** is illustrated suitable for implementing embodiments of the present disclosure, including mobile device **120**, one or more merchant servers or devices **130**, and payment service provider server or device **180**. System **500**, such as part of a cell phone, a tablet, a personal computer and/or a network server, includes a bus **502** or other communication mechanism for communicating information, which interconnects subsystems and components, including one or more of a processing component **504** (e.g., processor, micro-controller, digital signal processor (DSP), etc.), a system memory component **506** (e.g., RAM), a static storage component **508** (e.g., ROM), a network interface component **512**, a display component **514** (or alternatively, an interface to an external display), an input component **516** (e.g., keypad or keyboard), a cursor control component **518** (e.g., a mouse pad), and a sensor component **530** (e.g., gyroscope, accelerometer, and/or cameras). In accordance with embodiments of the present disclosure, system **500** performs specific operations by processor **504** executing one or more sequences of one or more instructions contained in system memory component **506**. Such instructions may be read into system memory component **506** from another computer readable medium, such as static storage component **508**. These may include instructions to present an on-screen code on a display of a mobile device, access measurements on one or more sensors of the mobile device, detect movements of the mobile device based on the measurements, and adjust the on-screen code to counteract movements based on the measurements, etc. In other embodiments, hard-wired circuitry may be used in place of or in combination with software instructions for implementation of one or more embodiments of the disclosure.

Logic may be encoded in a computer readable medium, which may refer to any medium that participates in providing instructions to processor **504** for execution. Such a medium may take many forms, including but not limited to, non-volatile media, volatile media, and transmission media. In various implementations, volatile media includes dynamic memory, such as system memory component **506**, and transmission media includes coaxial cables, copper wire, and fiber optics, including wires that comprise bus **502**. Memory may be used to store visual representations of the different options for searching, auto-synchronizing, making payments or conducting financial transactions. In one example, transmission media may take the form of acoustic or light waves, such as those generated during radio wave and infrared data communications. Some common forms of computer readable media include, for example, RAM, PROM, EPROM, FLASH-EPROM, any other memory chip or cartridge, carrier wave, or any other medium from which a computer is adapted to read.

In various embodiments of the disclosure, execution of instruction sequences to practice the disclosure may be performed by system **500**. In various other embodiments, a plurality of systems **500** coupled by communication link **520** (e.g., network **160** of FIG. **1**, LAN, WLAN, PTSN, or various other wired or wireless networks) may perform instruction sequences to practice the disclosure in coordination with one another. Computer system **500** may transmit and receive messages, data, information and instructions, including one or more programs (i.e., application code) through communication link **520** and communication interface **512**. Received program code may be executed by processor **504** as received and/or stored in disk drive component **510** or some other non-volatile storage component for execution.

In view of the present disclosure, it will be appreciated that various methods and systems have been described according to one or more embodiments for stabilizing an on-screen code on a display of a mobile device.

Although various components and steps have been described herein as being associated with user device **120**, merchant server **130**, and payment service provider server **180** of FIG. **1**, it is contemplated that the various aspects of such servers illustrated in FIG. **1** may be distributed among a plurality of servers, devices, and/or other entities.

Where applicable, various embodiments provided by the present disclosure may be implemented using hardware, software, or combinations of hardware and software. Also where applicable, the various hardware components and/or software components set forth herein may be combined into composite components comprising software, hardware, and/or both without departing from the spirit of the present disclosure. Where applicable, the various hardware components and/or software components set forth herein may be separated into sub-components comprising software, hardware, or both without departing from the spirit of the present disclosure. In addition, where applicable, it is contemplated that software components may be implemented as hardware components, and vice-versa.

Software in accordance with the present disclosure, such as program code and/or data, may be stored on one or more computer readable mediums. It is also contemplated that software identified herein may be implemented using one or more general purpose or specific purpose computers and/or computer systems, networked and/or otherwise. Where applicable, the ordering of various steps described herein may be changed, combined into composite steps, and/or separated into sub-steps to provide features described herein.

The various features and steps described herein may be implemented as systems comprising one or more memories storing various information described herein and one or more processors coupled to the one or more memories and a network, wherein the one or more processors are operable to perform steps as described herein, as non-transitory machine-readable medium comprising a plurality of machine-readable instructions which, when executed by one or more processors, are adapted to cause the one or more processors to perform a method comprising steps described herein, and methods performed by one or more devices, such as a hardware processor, user device, server, and other devices described herein.

What is claimed is:

1. A system, comprising:

a memory device storing motion sensor data; and

one or more processors in communication with the memory device and configured to:

display an on-screen code on a mobile device of a user;

receive the motion sensor data from one or more motion sensors of the mobile device;

detect movements of the mobile device based on the motion sensor data from the one or more motion sensors;

determine the display is turned to face a code scanner based on the movements; and

adjust the on-screen code to compensate for the movements based on the movements in response to determining the display is turned to face the code scanner.

2. The system of claim **1**, wherein the on-screen code comprises a payment code, and wherein the one or more processors are further configured to:

send a code request for a payment to a payment provider server;

receive the on-screen code, wherein the on-screen code is generated by the payment provider server based on the code request; and

receive a confirmation that the payment was processed from the payment provider server.

3. The system of claim **1**, wherein the on-screen code comprises a barcode or a QR code.

4. The system of claim **1**, wherein the one or more motion sensors comprise a gyroscope and an accelerometer.

5. The system of claim **1**, wherein the one or more processors are further configured to receive camera data from at least one front-facing camera of the mobile device.

6. The system of claim **5**, wherein the one or more processors are further configured to determine a distance to the code scanner based on the camera data from the at least one front-facing camera.

7. The system of claim **5**, wherein the one or more processors are configured to determine the display is turned to face the code scanner further based on detecting the mobile device is turned away from a face of the user based on the camera data from the at least one front-facing camera.

8. The system of claim **5**, wherein the one or more processors are configured to determine the display is turned to face the code scanner further based on detecting one or more parts of the code scanner based on the camera data from the at least one front-facing camera.

9. The system of claim **5**, wherein the one or more processors are further configured to:

detect one or more parts of the code scanner based on the camera data from the at least one front-facing camera; and

adjust the on-screen code relative to the one or more parts of the code scanner.

10. A method for stabilizing an on-screen code on a display of a mobile device, comprising:

sending, by one or more processors, a code request for a payment;

receiving, by the one or more processors, the on-screen code that is generated based on the code request;

presenting, by the one or more processors, the on-screen code on the display of the mobile device;

accessing, by the one or more processors, one or more motion sensors on the mobile device;

detecting, by the one or more processors, movements of the mobile device through the one or more motion sensors;

determining that the display is turned to face a code scanner based on the movements; and

adjusting, by the one or more processors, the on-screen code based on the movements, wherein the determining starts the adjusting of the on-screen code.

11. The method of claim **10**, wherein the movements comprise translation, rotation, or both.

12. The method of claim **10**, wherein the adjusting of the on-screen code comprises redisplaying the on-screen code at an adjusted position, an adjusted size, an adjusted shape, or a combination thereof.

13. The method of claim **10**, further comprising:

accessing, by the one or more processors, at least one camera on the mobile device;

determining, by the one or more processors, a distance between the mobile device and a code scanner through the at least one camera; and

adjusting, by the one or more processors, the on-screen code further based on the distance.

14. The method of claim **10**, further comprising receiving a confirmation that the payment was processed by a payment provider server, wherein the on-screen code is scanned by a code scanner at a merchant and sent to the payment provider server by the merchant.

15. A non-transitory machine-readable medium having stored thereon machine-readable instructions executable to cause a machine to perform operations comprising:

sending a code request for a payment to a payment provider server;

receiving an on-screen code, wherein the on-screen code is generated by the payment provider server based on the code request;

displaying the on-screen code on a display of a mobile device;

accessing measurements from one or more motion sensors of the mobile device;

detecting movements of the mobile device based on the measurements from the one or more motion sensors;

determining that the display is turned to face a code scanner based on the movements; and

adjusting the on-screen code to counteract movements based on the movements, wherein the determining starts the adjusting of the on-screen code.

16. The non-transitory machine-readable medium of claim **15**, wherein the operations further comprise:

accessing measurements from a front-facing camera of the mobile device; and

determining a distance between the mobile device and a code scanner based on the measurements from the front-facing camera, wherein the adjusting of the on-screen code is further based on the distance.

17. The non-transitory machine-readable medium of claim **15**, wherein the adjusting of the on-screen code comprises redisplaying the on-screen code with an adjusted position, an adjusted shape, an adjusted size, or a combination thereof.

18. The system of claim **1**, wherein the one or more processors are configured to adjust the on-screen code to compensate for the movements by redisplaying the on-screen code with an adjusted position, an adjusted size, an adjusted shape, or a combination thereof.

19. The method of claim **10**, further comprising:

accessing, by the one or more processors, at least one camera on the mobile device; and

detecting, by the one or more processors, one or more parts of the code scanner through the at least one camera, wherein the adjusting of the on-screen code is relative to the one or more parts of the code scanner.

20. The non-transitory machine-readable medium of claim **15**, wherein the operations further comprise:

accessing measurements from at least one camera on the mobile device; and

detecting one or more parts of the code scanner based on the measurements from the at least one camera,

wherein the adjusting of the on-screen code is relative to the one or more parts of the code scanner.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,424,570 B2
APPLICATION NO. : 14/459230
DATED : August 23, 2016
INVENTOR(S) : David Kenneth Fefferman

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE SPECIFICATION

In Column 7, Line 8, change "PUS" to --POS--.

In Column 7, Line 9, change "PUS" to --POS--.

Signed and Sealed this
Twenty-fifth Day of October, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office